

Fig. 4.—Examples from inland and high elevation populations. Localities in California, unless otherwise noted. All specimens leg. R. L. Langston.

Row 1.—*Pieris napi venosa*: 3 mi. NE. of Tuolumne City, Tuol. Co., ♂ 23 Mar. 1966; Rock Creek, 6 mi. NE. of Placerville, El Dorado Co., ♀ 12 April 1973. *Boloria epithore sierra*: Wet Meadow, 6900', above N. fork Stanislaus River, Tuolumne Co., ♂ 9 July 1969; Big Meadows, 6550', Hwy. 4, Calaveras Co., ♀ 30 June 1973.

Row 2.—*Apodemia mormo mormo*: Del Puerto Canyon, Stanislaus Co., ♂ 21 Aug. 1962; ♀ 6 Sept. 1962. *Callophrys lemberti*: Upper Lyons Creek, 7800', El Dorado Co., ♂ 11 June 1972; ♀ 6 June 1970; SE. shore, Loon Lake, 6352', El Dorado Co., ♀ 9 June 1973.

Row 3.—*Callophrys dumetorum*: Dunes 1 mi. E. of Antioch, Contra Costa Co., ♂, ♀ 11 April 1954. *Plebejus icarioides ardea* (Edwards): Angel Lake, 8000', Elko Co., Nevada, ♂ 26 June 1972; 5 mi. SW. of Henefer, Summit Co., Utah, ♀ 27 June 1972. *P. i. lycea* (Edwards): Pole Mtn. area, 8640' Albany Co., Wyoming, ♀ 6 July 1972.

Row 4.—*Plebejus pardalis*: Hill SW. of Paradise Cay, Marin Co., ♀ 23 May 1964; Berkeley Hills, Alameda Co., ♂ 17 April 1954; ♀ 22 May 1954; Calistoga, Napa Co., ♂ 24 April 1956; Hill 3 mi. NE. of Vallejo, Solano Co., ♀ 11 June 1967.

Row 5.—*Philotes enoptes tildeni*: Del Puerto Canyon, Stanislaus Co., ♂ PARATYPE, 11 Aug. 1962; ♂ TOPOTYPE, 9 Sept. 1967; ♀ TOPOTYPE, 11 Sept. 1963; Polonio Pass, 3 mi. E. of Cholame, San Luis Obispo Co., ♂, ♀ 27 Aug. 1973.

Row 6.—*Polites sonora sonora*: E. shore, Bucks Lake, 5153', Plumas Co., ♂ 23 June 1949; King Canyon W. of Carson City, Nevada, ♀ 22 June 1970; SW. of Genoa, 5700', Douglas Co., Nevada, ♂ 20 July 1964; Mineral King, 7831', Tulare Co., ♀ 3 Sept. 1949; Tioga Pass, 9941', Mono Co., ♀ 8 Sept. 1955.



*Apodemia mormo mormo* (Felder & Felder)

Based on numerous records (Opler & Powell, 1961), *A. mormo* in central and northern California is almost certainly univoltine, with adults in greatest abundance in late summer. This is opposed to *A. mormo virgulti* (Behr) which is multivoltine, with records from February to November. On this and other bases, it is felt by myself and others (correspondence, Mike Toliver), that *virgulti* may be a separate species.

On the sand dunes west of Seaside, Monterey Co., this "univoltine" *mormo* has been recorded from 4 July to 14 October in various seasons (Opler & Powell, 1961). Both sexes (with some worn) were taken on 4 July 1959, so the probable season started in late June. In several other seasons fresh and worn specimens were taken in August and September.

Further inland, at Del Puerto Canyon, western Stanislaus County, *mormo* were found only from mid-August to mid-September. This canyon in the Inner Coast Range was also visited several times in early August and no metal-marks were found.

*Callophrys viridis* (Edwards)

The upper ridges of the San Bruno Mountains, San Mateo County, are four miles inland from the coast. Although not on the immediate coast like the dunes, they certainly get their share of wind and cold, chilling fogs. Adults of *viridis* were recorded from the San Brunos from 26 Feb. 1963 to 4 June 1963 (Gorelick, 1971). This is definite for a single season, with numerous records for March and April in this and other years. The lower black bar represents slightly later dates for the populations on the dunes at Point Reyes, Marin County—30 March to 18 June (Gorelick, 1971). Since this is based on fewer records, the season probably extends from a little earlier to somewhat later.

After the data was compiled for the Gorelick study, *viridis* was discovered much further south—at the Marina Beach dunes, Monterey County by J. F. Emmel and the author on 11 May 1969. Large numbers were subsequently collected here in April and May, 1970-1973. All of these dates are well within the seasonal extremes of the northern populations.

*Callophrys dumetorum* (Boisduval) is found further inland in the dunes east of Antioch, Contra Costa County. The dates span from 18 March to 20 April (Gorelick, 1971; Opler & Lang-

ston, 1968). Throughout its extensive range most records are in March and April. The published records go from mid-February to early June, but not more than about a month at any single locality.

*Callophrys lemberti* Tilden is found much further inland and at higher elevations. Fewer records are available for this species. Its peak flight appears to be in early June at the 6 to 8000 foot levels in El Dorado County, and late June at 9 to 11,000 feet (Tioga Pass and Hoover Wilderness area, Mono County).

*Plebejus icarioides moroensis* (Sternitzky)

The dunes near Oso Flaco Lake, San Luis Obispo County have been visited by various collectors, but usually in different seasons. The earliest in the season appear to be 1 and 9 March 1972 by Bill Swisher, with *moroensis* recorded in April and May in other years. My latest record is 6 June 1966 when long series of mostly fresh ones were taken by myself and others. Therefore, the season probably extends at least another two weeks. It was not found on these dunes in August and September. The types were taken at Morro Beach, S.L.O. Co. on 27 June 1929. This is about 40 mi. NNW. of the populations indicated by the long black bar. J. A. Powell has also taken it sparingly in July on dunes to the north of Oso Flaco Lake. (These two are shown by the short black bar.)

The *icarioides* in the higher Sierra Nevada and the White Mountains, Mono County are dated from mid-June to mid-July. According to Downey (1962), "... members of a local population can be found in an area for about a 2-month period." Mid-June-July records are also prevalent for some of the other named subspecies in Nevada, Utah and Wyoming (specimens in Fig. 4).

*Plebejus icarioides missionensis* Hovanitz

The types were taken 1 April 1934 on Twin Peaks, San Francisco. Not far to the south, in the San Bruno Mountains, San Mateo County, I have taken it on 4 April 1971 and 27 June 1971—these extremes for a single season. There are numerous April, May and June dates in other years.

For comparison, *Plebejus pardalis pardalis* (Behr) was chosen from one colony in the Berkeley Hills—less than 20 miles to the northeast, but not on the immediate coast. The dates are 17 April 1954 to 22 May 1954—again a single season at the same place. This correlates with extensive records for *pardalis* in Contra



Costa County (Opler & Langston, 1968) from six distinct localities—all in April and May, none in March or June.

*Plebejus pheres* (Boisduval)

Originally described from San Francisco, it is now presumably extinct within the City—possibly its demise was similar to that of *Glaucopsyche xerces* (Boisduval). A morphologically close population to *pheres* is still found on the dunes at Point Reyes, Marin County. It has a flight period extending from mid-April to early July [2 July 1945, 1 ♀] based on examples at the California Academy of Sciences.

Further inland, *Plebejus pardalis* is again compared from the northeast—Napa and Solano Counties. The flight period appears to be late April to early June, with almost all of the records in May.

*Philotes enoptes smithi* Mattoni

On the dunes west of Seaside, Monterey County, this subspecies has been recorded from 20 June to 4 Sept. in various seasons. Most of the records are in August, but long series have been taken on several dates in July.

Further inland, *Philotes enoptes tildeni* Langston is found in the Inner Coast Range adjacent to the San Joaquin Valley, usually in August and September. The stippled bar represents one season at Del Puerto Canyon, western Stanislaus County. Only two fresh ♂♂ were taken 11 Aug. 1962, and the last collections were made 6 Sept. 1962. This is based on most of the type series cited in Langston (1963). In various other years the known dates go from 31 July to 11 Sept.

On 23 May 1967, six ♂♂ were taken in Del Puerto Canyon by Glenn Gorelick, and on 17 May 1973 another four ♂♂ by Jim Mori, indicating a spring flight (at least in some seasons). As with almost everything biological, there seem to be exceptions or "freak" occurrences.

Both *smithi* and *tildeni* could extend into late September or October, but I have no records of their actually being collected. This is predicted by correlation with *Apodemia mormo*, which is abundant at both localities and has the same *Eriogonum* hosts.

*Polites sonora siris* (Edwards)

West of Plantation in coastal Sonoma County, I collected good series of *siris* on 5 May 1955 and 23 July 1955—in the same season. It was present other years in June, early and mid-July. However, it was not found on visits to the exact same spot in

August and September. July specimens from western Washington are illustrated for comparison (Fig. 3). These show little variation from those in coastal northern California.

*Polites sonora sonora* (Scudder) is found in the Sierra Nevada at moderate to high elevations. More records are needed, but based on the few I have available, it flies from mid-June to late July from 5000 to 7000 feet, and in August to early September from 7000 to 10,000 feet.

*Panoquina panoquinoides errans* (Skinner)

This is the only other skipper in the whole Superfamily Hesperioidea that to my knowledge is restricted to the immediate coast of California. It violates the theme of those previously mentioned, as it probably has two or more generations per year. Comstock (1927) indicates it flying in mid-August and September. Most collections (especially those with large numbers), have *indeed* been in late summer. However, myself and others took it near Solana Beach, San Diego County as early as 19 June 1963, and it was still present on 1 July 1963—again in the same season.

Since there are no other species or subspecies of the genus *Panoquina* occurring in California, no inland comparison is made for *errans*.

## DISCUSSION

Climate:

*Outer Coast Range* and *beach dunes* of California—mild winters and cool summers.

Very seldom does the weather go below freezing, or does frost occur on the immediate coast. On sunny days in January and February the south-facing slopes and the protected sides of the dunes can get quite hot. Since it does not get extremely cold at night, the development of Lepidoptera (and other insects) can commence quite early in many seasons.

Conversely, in the summer the coastal slopes and dunes are successively plagued by long periods of cold winds and fogs. In some places for several days in a row (or even weeks) the sun may not shine. During these periods, new individuals do not emerge from their pupae, and those already in the adult stage often remain quiescent. They do not carry on their activities of taking nectar, mating or ovipositing. When the weather becomes clear and sunny before the next siege of fog, the adults resume their activities.

*Inner Coast Ranges* and *Sierra Nevada* of California—cold winters and hot summers.

The insect season is shorter inland, particularly at the higher elevations. Below freezing and winter frosts are common in the Inner Coast Ranges. Heavy snows and several months of below freezing are characteristic of the Sierra Nevada.

In the spring, the days may warm up suddenly, even though the nights may still be below freezing. When the days have warmed, it generally stays warm and gets progressively hotter as summer approaches. This will instigate rather quick and near total emergence of adults in a short period of time. With nothing to delay them, the adults take nectar, mate and oviposit. With all activities completed, the flight period is soon finished.

Host plants:

Directly correlated with the climate is the condition of the larval food-plants. It is not the purpose of this paper to specifically record the hosts of the various Lepidoptera concerned. Therefore, I will treat only some of the examples, and for brevity refer to the hosts by genus only.

*Pieris napi venosa* in the Coast Ranges seems to prefer *Dentaria* (milk-maids), although Bruce Walsh (personal correspondence) of Carmel Valley has also found it ovipositing on *Arabis* (mustard). This could well be an alternate host for it and gen. aest. *castoria*. On the immediate coast the *Dentaria* stays in green succulent growth for a long time. Further inland it grows faster, blooms and dries out rather quickly. Possibly the populations of *venosa* inland do not work over to several other cruciferous plants that would appear "suitable." This could explain the absence of *castoria* and a shorter adult flight of *venosa* in the more inland areas. On the West Slopes of the Sierra Nevada, one of the hosts appears to be *Radicula* (water-cress) found in slow-moving parts of creeks and the seepage from springs.

*Apodemia*, coastal *Callophrys* and *Philotes* are well documented in the literature (Opler & Powell, 1961; Gorelick, 1971; Langston, 1969, respectively) as feeding on various species of *Eriogonum* (wild buckwheat). In the coastal areas the *Eriogonum* has considerable leaf growth early in the season. The flowers develop over an extended period from spring through summer.

By mid-summer the plants in a local area may be in various stages of bud, blossom or seed. Further inland, each separate species of *Eriogonum* tends to bloom "all-at-once," with the flowers soon becoming unattractive, even as a nectar source.

The *Plebejus* species cited are all recorded as having various species of *Lupinus* (lupine) as their larval hosts. According to Downey (1962) the peak adult flight period seems to occur at about the same time as seed formation in the host lupines. The eggs are deposited singly on leaves, stems, flowers and seed pods. On the coastal dunes the lupines (especially the large yellow-flowered perennial) remain green and succulent all year. The blooming period is very staggered, with buds, flowers and young seed pods at the same time on the same and/or adjacent plants. Further inland and at higher elevations, most lupines are in bloom for a relatively short time in the "spring," set pods, and soon become incompatible as hosts.

#### SUMMARY and CONCLUSIONS

Several species of univoltine Rhopalocera found along the coast of California have very long adult flight periods. This is due to mild winters and cool summers, combined with the resultant staggered development of the various larval food-plants.

Just a short distance inland in the Coast Ranges and further inland in the Sierra Nevada, these same species (or closest known taxa) have much shorter adult flights. This is due to cold winters, warming in spring and hot summers. These short flight periods are also correlated with increased elevation and a rather quick and uniform development of the larval food-plants, and their soon becoming unsuitable.

Examples of ten coastal entities among the families Pieridae, Nymphalidae, Riodinidae, Lycaenidae and Hesperidae are compared with their inland counterparts.

#### ACKNOWLEDGMENTS

Some of the examples in this study were taken from my field notes while on collecting trips with the California Insect Survey. I wish to thank Dr. J. A. Powell, University of California, Berkeley and others involved with the Survey for the opportunity to make these collections. Specimens were examined at the California Academy of Sciences, San Francisco for additional records. I am indebted to Dr. P. H. Arnaud for his cooperation and ac-



cess to the CAS collections. I am grateful to the many who have contributed to the Zone 1 Season Summary since I became coordinator. Data was gleaned from their contributions, and particularly the related correspondence of those mentioned in the text.

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### APPENDIX

Many of the dates and locations cited in the text are based on specimens in the two accompanying photographs. These data are given in the legends to the figures.

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## HABITAT: BREPHIDIUM PSEUDOFEA (LYCAENIDAE)<sup>1</sup>

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*Brephidium pseudofea* (Morrison) typically is found in association with *Salicornia bigelovii* (Chenopodiaceae), the only definitely known host plant, along the coasts of Florida and somewhat further north. The illustration is of an area along the west coast of central Florida: Cedar Key, Levy County (19 Dec 1973).

*Salicornia virginica* is the predominant plant in the foreground, with some *Salicornia bigelovii* mixed in, left. Perhaps *S. virginica* is an alternate host; Rawson (1961, J. N. Y. Entomol. Soc. 69:88-91) has also suggested *Batis maritima*. *B. maritima* is a prostrate plant with succulent leaves growing near the *Salicornia*. The saltmarsh grasses to the left and in the background are mostly *Spartina alterniflora* (Gramineae). Bushes in the picture include *Avicennia germinans* (Verbenaceae) (large bush, right) and the smaller *Lycium carolinianum* (Solanaceae) (center, right), the latter in bloom and attracting other lepidopterous species (*Danaus*, *Agraulis*, *Urbanus*, *Panoquina*) but no *Brephidium* were observed on the *Lycium* flowers. *B. pseudofea* flies in colonies as many other lycaenids tend to do and has been reported to be generally uncommon in Florida, encountered in numbers only occasionally. Flight records are year round in the southernmost areas except for the months of August and November (Kimball, 1965, Lep. Fla., p. 49).

<sup>1</sup>Florida Agricultural Experiment Station Journal Series No. 5309.

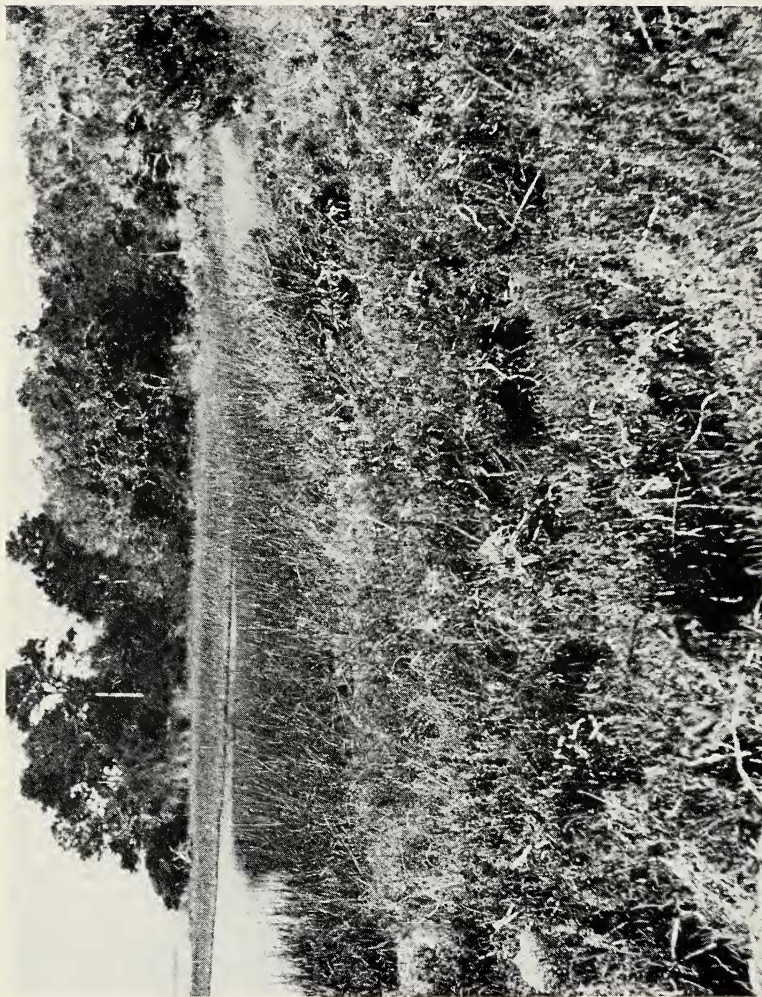


Fig. 1.—Coastal strand with *Salicornia* spp. in foreground on west end of Cedar Key, Levy Co., Florida. (19 Dec 1973)